REMARKS

Applicants respectfully request reconsideration and allowance of the pending claims.

I. Status of the Claims

Upon entry of this amendment, claims 1, 2, 5-9, and 74-78 remain pending, while claims 3, 4, 72, and 73 have been canceled.

Claims 1, 2, 5-8, and 74-77 have been amended to clarify the claims and to claim preferred embodiments. Support for these amendments may be found in the applicants' published application at paragraphs [0016]-[0018], paragraphs [0026]-[0027], paragraph [0035] and FIG. 5.

Claims 79-94 are new and are supported by applicants' specification at paragraphs [0051]-[0052].

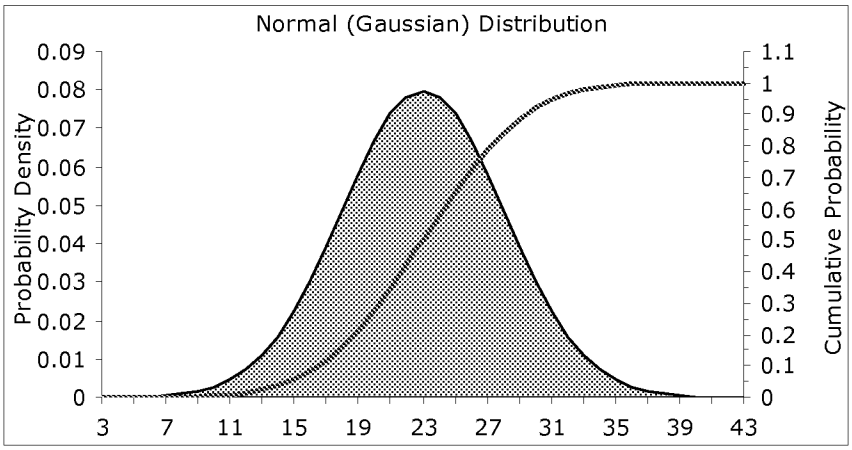
II. Claim Rejections Under 35 U.S.C. 103(a)

Reconsideration is requested of the rejection of claims 1-9 and 72-78 as being obvious over Itoh et al. (U.S. 5,024,905).

Claim 1 is directed to a composition for use as a catalyst in oxidation or reduction reactions, the composition comprising

1) electrocatalyst alloy particles comprising an alloy of platinum and copper,
2) wherein (i) the concentration of platinum in the electrocatalyst alloy particles is greater than 50 atomic percent and less than about 80 atomic percent, and
3) (ii) the electrocatalyst alloy particles have an average particle size which is less than 25 angstroms (Å).

Claim 1 has been amended to clarify that the composition comprises electrocatalyst alloy particles comprising an alloy of platinum and copper. It is well known in the metallurgical arts that an alloy is a solid solution between two or more metals. The electrocatalyst alloy particles in the composition of claim 1 are therefore alloy particles in which the platinum and copper are formed into an alloy, i.e., a solid solution. Moreover, the platinum and copper precursors (be they platinum and copper metal or platinum and copper salts or some combination) are formed together into a population of alloy particles that are characterized by a particle size distribution which requires the average particle size be less than 25 Å. The below chart is a graphical illustration of a particle size distribution having an average particle size of less than 25 Å (in this example, the average particle size is 23 Å, the standard deviation is 5 Å, and the distribution is normal):



As is apparent from this chart, if the distribution is normal, particle sizes may vary from as small as 7 Å to as large as 39 Å, but the average particle size is 23 Å.

This chart is just one example of such a particle size distribution and does not limit the claim interpretation. Particle size distributions falling within the claim scope include those having average particle sizes of, e.g., 24 Å, 19

Å, 14 Å, etc. and the standard deviation may be other than 5 Å, e.g., 4 Å, 12 Å, etc., and the distribution may be other than normal, e.g., skewed, so long as the average particle size of the electrocatalyst alloy particles is less than 25 Å, the claim limitation is met. The critical claim feature in the composition defined by claim 1 is the requirement that the average particle size of all of the particles is less than 25 Å, which allows individual particle sizes to range from above and below 25 Å, as long as the distribution is such that the average particle size is less than 25 Å.

The cited Itoh et al. reference does not disclose any composition comprising Pt-Cu electrocatalyst alloy particles in which the average particle size is less than 25 Å, nor does the reference even enable the ordinarily skilled person to prepare such a population of Pt-Cu alloy particles.

First, applicants address the following statement contained in the Advisory Action:

> The applicants argue that Itoh does not teach "average" particle size is less than 25 Angstroms. In response, although the reference, Itoh, does not specifically employ the word "average", in view of the lack of any disclosure of the particle size classification, it would stand to reason that Itoh's particles sizes are, in fact, AVERAGE particle sizes.

Applicants completely agree with the statement "it would stand to reason that Itoh's particles sizes are, in fact, AVERAGE particle sizes" to the extent that they refer to the "Crystallite size" of each alloy described in Tables 1 and 2 of Itoh et al. The "Crystallite size" values of the far right column in Tables 1 and 2 are the ***average particle sizes*** of the alloy particles disclosed therein. Applicants did not assert in their Amendment C that Itoh et al. did not disclose "averages." Applicants' remarks were directed to the failure of the Itoh et

al. reference to disclose average particle sizes of ***less than 25 angstroms***. In this regard, all of the "Crystallite size[s]" (which are averages) pertaining to alloys disclosed in Tables 1 and 2 are above 25 Å. The lowest value pertaining to an alloy is 31 Å. See Production Example 3 in Table 1. The average particle sizes for alloys comprising Pt and Cu only were 35 and 37 Å. See Production Examples 13 and 14 in Table 1. Therefore, Itoh et al. did not disclose any alloy whatsoever -- not one -- in which the average particle size met the claimed limitation of less than 25 Å. That the electrocatalyst particles are Cu-Pt alloy and have an average particle size of less than 25 Å are affirmative requirements which cannot be ignored in assessing patentability.

The Office has further cited Itoh et al. at Col. 9, lines 54-55, which stated "the composition of the alloy particles having a size of 25 to 50 Å was Pt:Fe:Co:Cu..." for supporting obviousness. This disclosure in Itoh et al. referred to Production Example 2, which had a "Crystallite size," i.e., average particle size of 33 Å. By the Office's own assertion above, which applicants' agree with, Production Example 2 had an average particle size of 33 Å, which excludes the possibility that any of the values in the range 25 to 50 Å were an *average* particle size -- Since the "Crystallite size" of Production Example 2 was 33 Å and since the Office and applicants both agree that value is the average, any other value in the range associated with that very same Production Example cannot be the average.

Rather, Itoh et al. were describing a population of Pt-Fe-Co-Cu alloy particles in which individual particles were observed to range in size from 25 to 50 Å, with an average of 33 Å. This example does not meet the limitations of the claims

since the average "Crystallite size" is 33 Å. While some of the particles may have had particle sizes less than 33 Å, Production Example 2 differs from the composition defined by claim 1 in the critical respect that its ***average particle size of 33 Å*** is substantially above the average particle size limitation of the electrocatalyst particles of claim 1, which is 25 Å.

In response to the statement in the Advisory Action that "the Applicants rely on examples taught by Itoh; however, a reference is never limited to merely what it sets forth in the examples... Itoh further teaches that it is preferred that the particle size is less than 30 angstroms (column 7, lines 8-9)." The paragraph relied upon in this assertion does not disclose or make obvious the claimed composition comprising Pt-Cu electrocatalyst alloy particles in which the average particle size is less than 25 Å since the "less than 30 angstroms" language does not pertain to alloys, but rather to precursor materials, i.e., metal compounds, that are used to prepare the alloys. The entirety of the paragraph that contains the excerpted language and portions of the next paragraph of Itoh et al. make this point clear:

> The ***preferred alloy crystallite diameter of the ternary ordered alloy in accordance with this invention is not more than 100 Å, especially not more than 50 Å.*** To obtain such fine crystallite, the slurry concentration, the rate of dropwise addition of the fixing agent and the stirring speed in the loading step and the heat-treatment temperature and time in the reduction and alloying step should be controlled so that the ***particle diameter of the metals or their compounds loaded on the catalyst precursor*** is not more than 50 Å preferably not more than 30 Å.
>
> The temperature, at which a tetragonal ordered alloy as a preferred crystal structure in accordance with this invention is formed, depends also upon the chemical existing states of the individual metal

> components on the catalyst precursor. As stated hereinabove, a tetragonal ordered alloy can be formed at 850° to 900°C by subjecting ***a catalyst precursor containing platinum and iron to reduction and alloying treatment at 800° to 900°C*** to form a cubic ordered ***alloy*** of platinum and iron, dispersing and depositing copper on it, and again heating the mass for alloying. On the other hand, when iron and copper are loaded simultaneously on a supported platinum catalyst and alloying is carried out in one step, high temperatures of 950° to 1,050°C are required to obtain a tetragonal ordered alloy. According to the two-step alloying method in accordance with this invention, although the catalyst preparation procedure is more complicated, a tetragonal ordered alloy can be formed at lower temperatures. As a result, the crystallite size of the resulting alloy can be made smaller than in the case of one-step alloying, and an alloy catalyst having a larger metal surface area can be formed. The resulting catalyst has the synergistically large mass activity, which is obtained as the product of the larger metal surface area multiplied by higher specific activity to be described below, and its performance is high.

The terms "metals or their compounds," "catalyst precursor," and "alloy" in the above description from Itoh et al. are particularly emphasized to point out that Itoh et al. referred to the particle sizes of separate and distinct materials at separate and distinct steps in their process for forming electrocatalyst particles.

With regard to the "***metals*** or their ***compounds*** loaded onto the ***catalyst precursor***," Itoh et al. refer to the materials that are reacted together such as platinum metal or platinum salts, iron metal or iron salts, etc. on the carbon-based carrier in preparing the final alloy particles under reductive heat treatment. Itoh et al. refer to these reactants as "metals," "metal compounds," and "catalyst precursor" earlier in the specification. See Col. 5, lines 62-63; Col. 6, line 12, and Col. 6, line 28, describing the "slurry of the catalyst

precursor having platinum, iron, cobalt and copper dispersed and deposited thereon..." It is these materials that possess the particle sizes "not more than 50 Å, preferably not more than 30 Å." Further evidence of this meaning may be found in the next paragraph, where Itoh et al. describe heat treating the "catalyst precursors" (i.e., the materials having particle sizes "not more than 50 Å, preferably not more than 30 Å") in a reductive atmosphere to prepare the ordered alloys (i.e., the materials having sizes of less than 100 Å, preferably less than 50 Å).

With regard to the "alloy crystallite diameter of the ternary ordered alloy," Itoh et al. did not disclose that the final order alloy particles have particles sizes "not more than 50 Å, preferably not more than 30 Å." Rather, Itoh et al. state that the preferred alloy crystallite diameter "is not more than 100 Å, especially not more than 50 Å." That is, Itoh et al. disclose that, in order to prepare final ordered alloys that are preferably less than 100 Å, especially not more than 50 Å, it is necessary to use precursors having particle sizes "not more than 50 Å, preferably not more than 30 Å." There is no evidence whatsoever that Itoh et al. disclosed or enabled the preparation of alloy particles having an alloy particle size of less than 30 Å, or more importantly less than the 25 Å required by the claims. As shown by their examples, they consistently prepared alloys having average particle sizes in the 30 plus Å range -- but, applicants' claims require a much stricter average particle size of less than 25 Å. Itoh et al. simply did not disclose any such composition.

Simply stated, the proper reading of Itoh et al. makes it exceedingly clear that while the *precursor* materials may have

relatively small particle sizes of less than 30 Å, the alloy particles themselves are not less than 30 Å.

In view of the critical shortcomings of Itoh et al., which does not disclose any alloy particles having an average particle size less than 25 Å, *prima facie* obviousness cannot be established.

Finally, even though the claims are directed to a composition and patentability is determined by comparing the claim limitations of the composition against the composition disclosed in the cited reference, Itoh et al.'s process of making the alloy particles is relevant to the extent that Itoh et al.'s method is wholly incapable of preparing a composition comprising alloy particles in which the average particle size of the alloy particles is less than 25 Å. Itoh et al. did not disclose any composition which meets all of the claim limitations, nor did their disclosure provide the ordinarily skilled person with any reasonable expectation that their teachings could be successfully applied toward producing Pt-Cu alloy particles having the claimed platinum concentration and the average particle size requirement. See MPEP §2143.02:

> **2143.02 Reasonable Expectation of Success Is Required**
> A rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art. *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, ___, 82 USPQ2d 1385, 1395 (2007); *Sakraida v. AG Pro, Inc.*, 425 U.S. 273, 282, 189 USPQ 449, 453 (1976); *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 62-63, 163 USPQ 673, 675 (1969); *Great Atlantic & P. Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 152, 87 USPQ 303, 306 (1950).

Section II of MPEP 2143.02 goes on to describe that applicants' rebuttal evidence showing there is no reasonable expectation of success supports a finding of non-obviousness, and further to describe specific situations where this has occurred. A first piece of evidence that the ordinarily skilled person would not have had any reasonable expectation of successfully preparing catalyst alloys having an average particles size less than 25 Å by applying Itoh et al.'s techniques is Itoh et al.'s total failure in preparing any such material, as described above. Itoh et al. prepared 31 alloys and *not one* of those alloys exhibited average crystallite size of less than 30 Å, much less the claimed requirement of an average of less than 25 Å. Moreover, the disclosure of particle sizes of "not more than 50 Å, preferably not more than 30 Å" refers only to the "catalyst precursor," i.e., the "metal compound" reactants and not to the final alloy product.

Finally, it is not enough that a prior art reference recites the limitations of a pending claim; the disclosure must be an enabling one. Itoh et al. failed to enable the preparation of Pt-Cu alloy particles having an average particle size of less than 25 Å. The Federal Circuit has stated that "even if the claimed invention is disclosed in a printed publication, that disclosure will not suffice as prior art if it was not enabling." *In re Donohue*, 766 F.2d 531, 533 (Fed. Cir. 1985), citing *In re Borst*, 345 F.2d 851, 855, 145 USPQ 554, 557 (CCPA 1965). Additionally, as endorsed by MPEP §2121 and the Federal Circuit's recent opinion in *Impax Laboratories, Inc. v. Aventis Pharmaceuticals Inc.*, 88 USPQ2d 1381 (Fed. Cir. 2008), the standard is whether the prior art reference enables the ordinarily skilled person to make the claimed invention without undue experimentation. See 88 USPQ2d at 1383:

> In order to anticipate a claimed invention, a prior art reference must enable one of ordinary skill in the art to make the invention without undue experimentation. Finisar Corp. v. DirecTV Group, Inc., 523 F.3d 1323, 1336 [86 USPQ2d 1609] (Fed. Cir. 2008) (citing In re Omeprazole Patent Litig., 483 F.3d 1364, 1379 [82 USPQ2d 1643] (Fed. Cir. 2007)). In other words, ***the prior art must enable the claimed invention.*** Minn. Mining & Mfg. Co. v. Chemque, Inc. (3M), 303 F.3d 1294, 1301 [64 USPQ2d 1270] (Fed. Cir. 2002).

In this regard, applicants are not contesting the ability of the ordinarily skilled person to employ Itoh et al.'s technique for preparing catalyst materials having average particle sizes of 31 Å or more, as evidenced by multiple production examples shown in Tables 1 and 2. However, applicants' claims specifically and expressly require average particle size of less than 25 Å. The standard as set forth in *Donahue*, *Borst*, and *Impax Laboratories* requires the Office to show that the reference enables preparation of Pt-Cu catalyst alloy particles having an average particle size of less than 25 Å or else *prima facie* obviousness cannot be established. Recognition that smaller particle sizes is desirable is not enough to render the claims obvious when, as here, Itoh et al. utterly fail to disclose any process capable of preparing any material meeting the claimed average particle size limitation, or even suggest process modifications that may result in particles meeting the limitation. Itoh et al.'s 31 production examples -- none of which even approach the claimed average particle size limitation -- are substantial evidence of non-enablement of preparing particles having average particle sizes of less than 25 Å. In view thereof, applicants respectfully submit that the reference does not render the claims obvious for the additional reason that the reference does not enable the claimed subject matter.

In view of the foregoing, the Itoh et al. reference neither anticipates nor renders obvious the compositions of claim 1, and applicants request the rejection be withdrawn.

Claims 2, 5-9, and 74-78 depend from claim 1 and are patentable for the same reasons as claim 1 and by virtue of the additional requirements therein.

For example, claims 5, 6, 74, and 75 require the alloy particles have average particle sizes of less than 20 Å, or less than 15 Å. These claims are additionally patentable over Itoh et al. since the reference does not disclose any composition having average particle sizes less than 20 Å nor, of course, does it enable making any such composition. In fact, the composition which had the smallest particle size was the pure platinum catalyst, having an average particle size of 23 Å.

III. Double Patenting Rejections

Applicants acknowledge the provisional double patenting rejection of claims 1-8 and 72-77 over co-pending application Ser. No. 11/205,557 and the provisional double patenting rejection of claims 1-9 and 72-78 over co-pending application Ser. No. 11/341,119. Unless and until the co-pending applications mature into patents or the double patenting rejection is the sole remaining rejection in the present case, the appropriateness of the rejection cannot be ascertained. Applicants therefore request that the double patenting rejection be held in abeyance until one of these conditions is met.

IV. New Claims

New claims 79-94 further define the distribution of electrocatalyst alloy particles by requiring a minimum percentage of the particles fall within minimum and maximum

particle size boundaries. A special advantage of applicants' method is the ability to prepare a population of particles having a relatively narrow particle size distribution. Itoh et al. do not disclose the particle size minima and maxima about their average "Crystallite size" for most of their Example alloys. Additionally, Itoh et al. did not disclose the percentage of particles that are within particle size boundaries for any of their Examples.

The only Example in Itoh et al. that disclosed a range is Production Example 2 at Col. 9, lines 54-55 in which the particle sizes ranged from 25 Å to 50 Å and had an average particle size of 33 Å. In this example, at least some of the particles observed were 50 Å in size, which is 51.5% larger than the average "Crystallite size." Itoh et al. did not disclose, however, the percentage distribution of particles within the range.

CONCLUSION

In view of the foregoing, applicants respectfully request favorable consideration and allowance of the pending claims. Applicants do not believe that a fee is required for the filing of this response, as it is being submitted within the 3-month shortened statutory period for reply. Should applicants be incorrect, the Commissioner is hereby authorized to charge the necessary fee to Deposit Account No. 19-1345.

Respectfully submitted,

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